

Datasheet

BT852

Bluetooth Dual-Mode USB HCI Module

Version 1.0

REVISION HISTORY

Version	Date	Notes	Contributor	Approver
1.0	15 July 2019	Preliminary Release	Jacky Kuo	

CONTENTS

1	Scope	4
2	Operational Description	4
	Features and Benefits	4
	Application Areas	4
3	Block Diagram and Descriptions	5
4	Specifications	6
5	DC Electrical Characteristics	7
6	RF Characteristics	7
7	Antenna Performance	9
7.1.	PCB Printed Antenna Pattern	9
7.2.	Antenna Matching – S11 Results	10
8	Mechanical Dimensions	11
9	Japan (MIC) Regulatory	12
10	FCC Regulatory	12
10.1.	Federal Communication Commission Interference Statement	12
11	Industry Canada Regulatory	13
12	European Union Regulatory	15
12.1.	EU Declarations of Conformity	15
13	Bluetooth SIG Approvals	16
13.1.	Application Note: Subsystem Combinations	16
	Laird Customer Declaration ID Procedure	16
14	Additional Assistance	18

SCOPE

This document describes key hardware aspects of the Laird BT852 Bluetooth HCI module and Adapter. This document is mainly intended to assist device manufacturers and related parties with the integration of this module into their host devices. Data in this document are drawn from several sources including data sheets for the Cypress CYW20704A2.



OPERATIONAL DESCRIPTION

The BT852 of USB HCI modules and Adapter leverage the Cypress CYW20704 A2 chipset to provide exceptionally low power consumption with both Classic Bluetooth and Bluetooth Low Energy support. The Bluetooth v4.2 core specification shortens your development time and provides enhanced throughput, security and privacy.

The BT852 Pluggable USB Adapter with inbuilt Bluetooth stack simply plugs into any Windows, Android or Linux device via external USB connection.

Features and Benefits

- Bluetooth v4.2 - Dual Mode (Classic Bluetooth and BLE)
- Good antenna radiation gain and efficiency
- Good interference rejection for multi-com system (GSM/WCDMA)
- Class 1 output – +7 dBm
- Industrial temperature range
- 512 k EEPROM support
- Bluetooth Controller subsystem
- FCC, IC, CE, RCM and Giteki approvals

Application Areas

- Medical devices
- ePOS terminals
- Barcode scanners
- Industrial cable replacement
- IoT Platforms Automotive Diagnostic Equipment
- Personal Digital Assistants (PDA)

BLOCK DIAGRAM AND DESCRIPTIONS

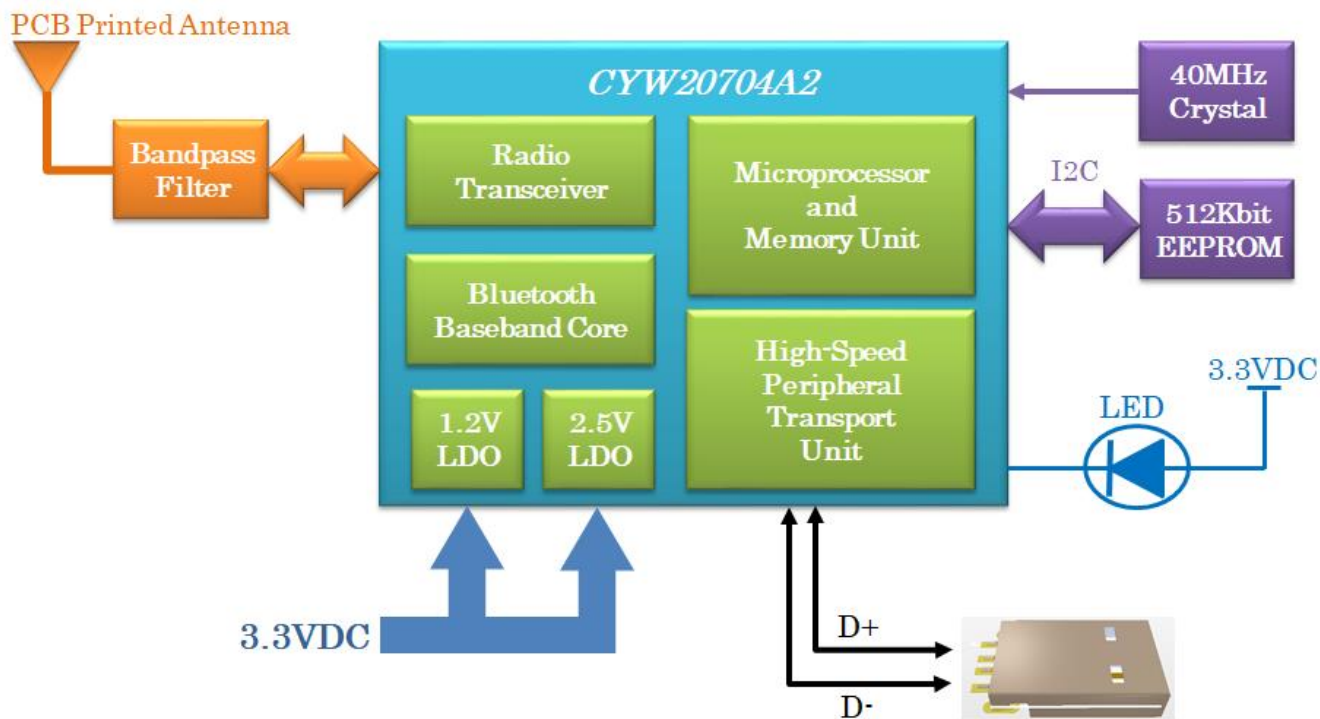


Figure 1: BT852 USB Dongle Block Diagram

Table 1: Block diagram descriptions

CYW20704A2 (Main chip)	The BT852 is based on CYW20704A2 dual mode chip. The chip is a single-chip radio with on-chip LDO regulators and baseband IC for Bluetooth 2.4 GHz systems including EDR to 3 Mbps. Dedicated signal and baseband processing is included for full Bluetooth operation.
Antenna	A PCB printed antenna used for cost effectivity.
Band Pass Filter	The band pass filter filters the out-of-band emissions from the transmitter to meet the specific regulations for type approvals of various countries.
EEPROM	There are 512 k bits EEPROM embedded in the dongle which can be used to store parameters, such as BD_ADDR, USB enumeration information, maximum TX power, USB product ID, USB vendor ID, and USB product description.
Crystal	The embedded 40 MHz crystal is used for generating the clock for the dongle.

SPECIFICATIONS

Table 2: BT852 specifications

Categories	Feature	Implementation
Wireless Specification	Bluetooth®	V4.2 Dual Mode – BR / EDR / LE
	Frequency	2.402 - 2.480 GHz
	Maximum Transmit Power	Class 1 +7 dBm from antenna
	Receive Sensitivity	-94 dBm
	Range	Circa 100 meters
	Data Rates	Up to 3 Mbps (over-the-air)
Host Interface	USB	Full speed USB 2.0
Operational Mode	HCI	Host Controller Interface over USB
EEPROM	2-wire	512 K bits
Supply Voltage	Supply	3.0V - 3.6V
Power Consumption	Current	Idle Mode ~8 mA File Transfer ~43 mA
Antenna Options	Internal	PCB Printed Antenna
Physical	Dimensions	16 x 43 x 11 mm
Environmental	Operating	-30° C to +85° C
	Storage	-40° C to +85° C
Miscellaneous	Lead Free	Lead-free and RoHS-compliant
	Warranty	One-year warranty
Approvals	Bluetooth®	Controller Subsystem Approved
	FCC/IC/CE/RCM/Giteki	BT852

DC ELECTRICAL CHARACTERISTICS

Table 3: Absolute Maximum Rating

Rating	Min	Max	Unit
Storage temperature	-40	+150	°C
Operating Temperature	-30	+85	°C
ESD Contact Discharge	-4	+4	KV
ESD Air Discharge	-8	+8	KV
Moisture Sensitivity Level	4	-	-
3V3 Input	3.0	3.6	V

Table 4: Recommended operating conditions

Rating	Min	Max	Unit
Storage temperature	-40	+150	°C
Operating Temperature	-30	+85	°C
3V3 Input	3.0	3.6	V

Table 5: Current consumption

Normal Operation	Peak (8 dBm)	Unit
Idle	8	mA
Inquiry	23	mA
File Transfer	43	mA
BLE Connected (Master)	26	mA
BLE Scan (Master)	26	mA
BLE File Transfer	27	mA

RF CHARACTERISTICS

Table 6: BDR/EDR/LE transmitter characteristics (Input = 3V3 @ 25 °C)

Parameter	Min	Typ.	Max	BT. Spec.	Unit
Classic BT (BDR) - GFSK Maximum RF Transmit Power	6	8	10	20	dBm
Classic BT - EDR Maximum RF Transmit Power	2	4	6	20	dBm
BLE Maximum RF Transmit Power	6	8	10	20	dBm
RF power variation over temperature range	-	2.0	-	-	dB
RF power variation over BT band	-	2	-	-	dB
RF power control step	2	4	8	-	dB
Initial Carrier Frequency Tolerance	-	10	-	±75	kHz
BLE Frequency Accuracy	-	10	-	±150	kHz
20 dB Bandwidth	-	920	-	1000	kHz
In-Band Spurious Emissions	1.0 MHz < M-N < 1.5 MHz	-	-	-39	dBc
	1.5 MHz < M-N < 2.5 MHz	-	-	-39	dBm

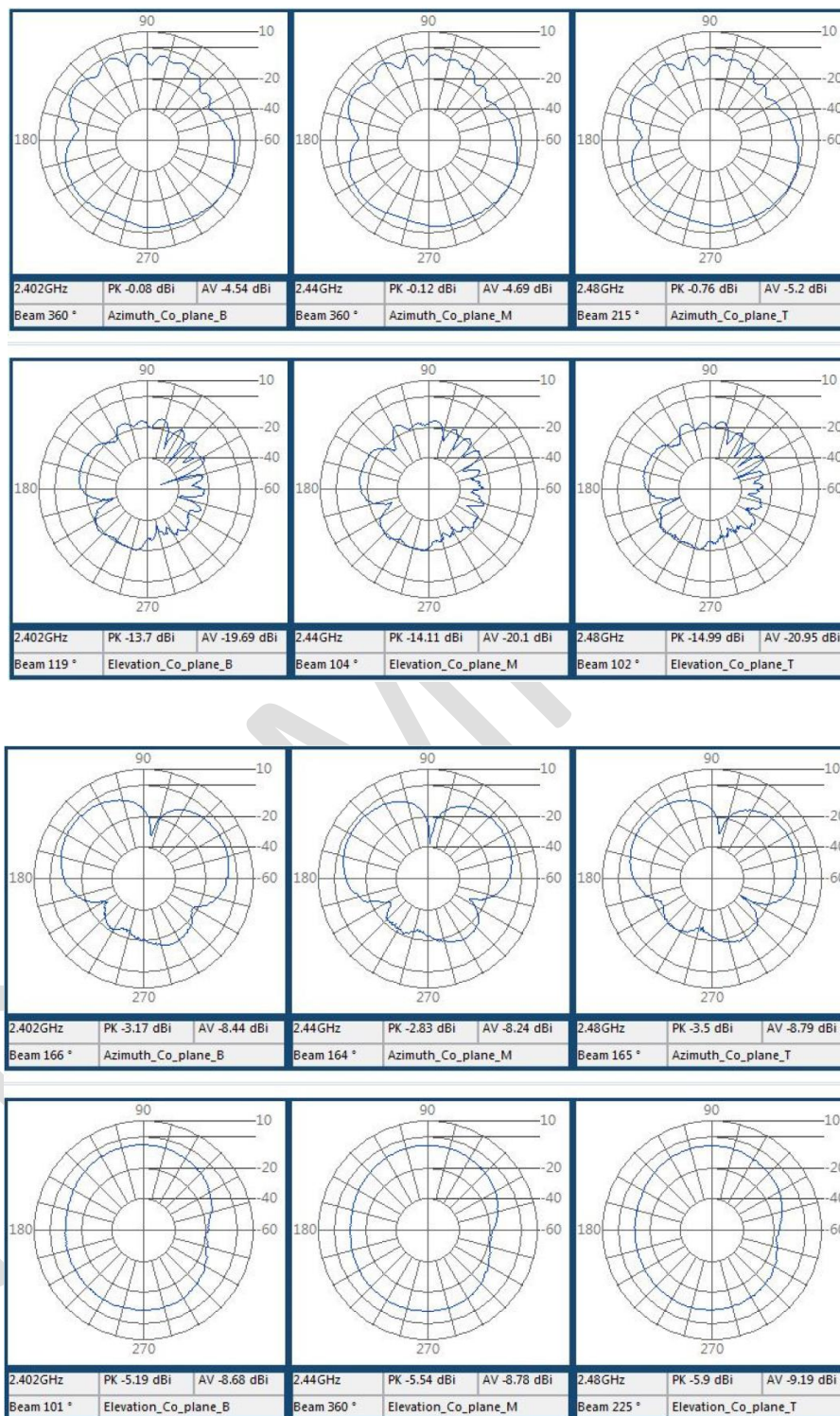
Parameter		Min	Typ.	Max	BT. Spec.	Unit
BLE In-Band Emission	$ M-N \geq 2.5 \text{ MHz}$	-	-	-47	-40	dBm
	$f_{TX} \pm 2 \text{ MHz}$	-	-	-48	-20	dBm
	$f_{TX} \pm [3 + n] \text{ MHz}$	-	-	-47	-30	dBm
Drift rate		-	10	-	+/-25	kHz
$\Delta F1_{Avg}$		-	152	-	140<>175	kHz
$\Delta F2_{Max}$		100	-	-	99.9	%
$\Delta F2_{Avg} / \Delta F1_{Avg}$		-	1.0	-	≥ 0.8	
BLE $\Delta F1_{Avg}$		-	245	-	225<>275	kHz
BLE $\Delta F2_{Max}$		100	-	-	99.9	%
BLE $\Delta F2_{Avg} / \Delta F1_{Avg}$		-	1.0	-	≥ 0.8	

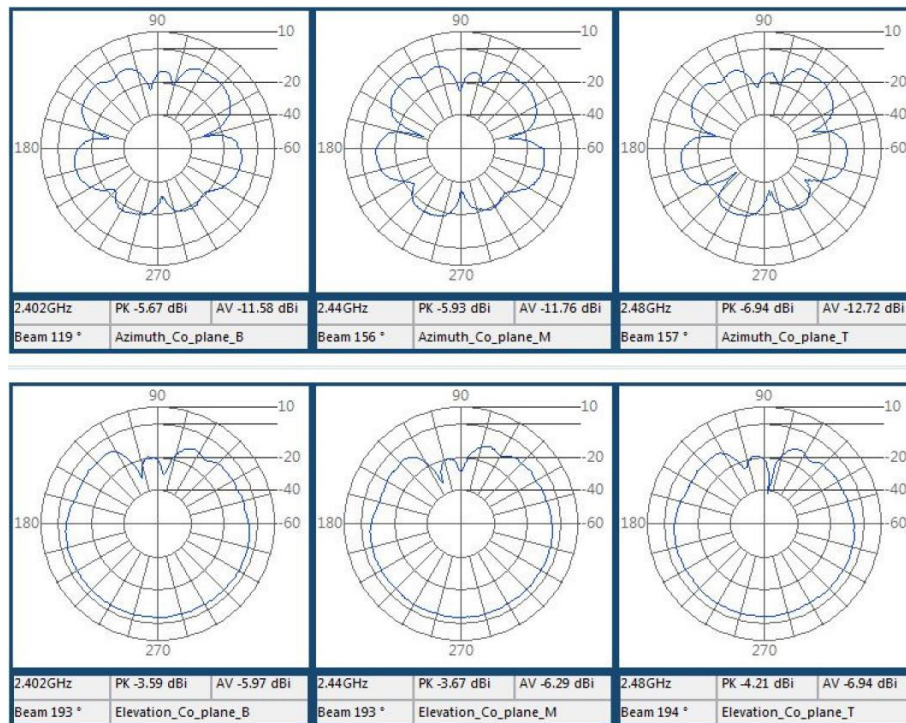
Table 7: BDR/EDR/LE receiver sensitivity (Input = 3V3 @ 25 °C)

Parameter	Conditions	Min	Typ.	Max	BT. Spec.	Unit
Sensitivity	GFSK, 0.1% BER, 1 Mbps		-90		-70	dBm
	$\pi/4$ -DQPSK, 0.01% BER, 2 Mbps		-90		-70	dBm
	8-DPSK, 0.01% BER, 3 Mbps		-85		-70	dBm
	BLE GFSK, 30.8% PER, 1 Mbps		-94		-70	dBm
Sensitivity variation	All Modulations (Over BT band)		2			dB

ANTENNA PERFORMANCE

7.1. PCB Printed Antenna Pattern





7.2. Antenna Matching – S11 Results

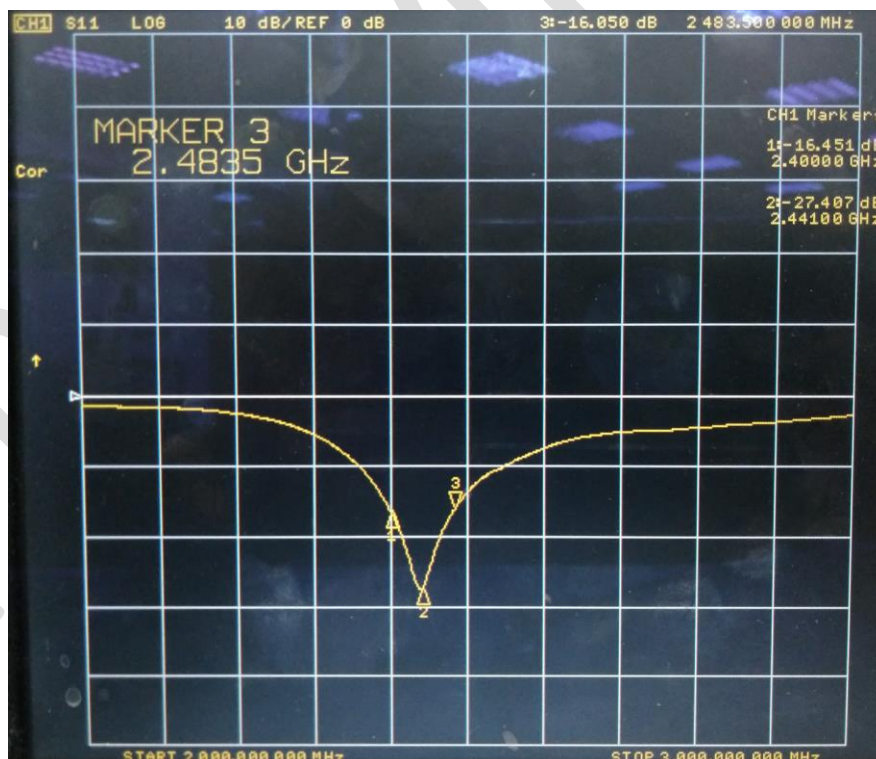


Figure 2: Antenna S11 on board

MECHANICAL DIMENSIONS

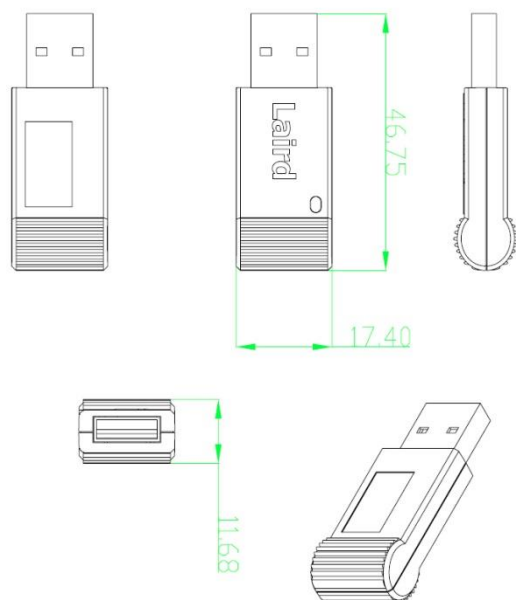


Figure3: BT852 USB dongle outline dimension

JAPAN (MIC) REGULATORY

*** Will be ready later

The BT85x is approved for use in the Japanese market. The part numbers listed below hold WW type certification. Refer to **ARIB-STD-T66** for further guidance on OEM's responsibilities.

Table 3: BT85x Japan regulatory information

Model	Product Name	Description	Certificate No.
BT852	Bluetooth Dual Mode USB Adapter	Mounted with chipset antenna	xxx-xxxxxx

FCC REGULATORY

Model	US/FCC
BT852	SQGBT852

10.1. Federal Communication Commission Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in an installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference; and
- This device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT NOTE:

FCC Radiation Exposure Statement:

The product complies with the US portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

This device is intended only for OEM integrators under the following condition:

1. The transmitter module may not be co-located with any other transmitter or antenna,

If the condition above is met, further transmitter testing is not required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

IMPORTANT NOTE

If this condition cannot be met (for example, certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator is responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following: “Contains FCC ID: SQGBT852

Manual Information to the End User

The OEM integrator must be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

INDUSTRY CANADA REGULATORY

Model	CANADA/IC
BT852	3147A-BT852

The BT85x modules were tested with the following antennas:

This device complies with Industry Canada’s licence-exempt RSSs. Operation is subject to the following two conditions:

1. This device may not cause interference; and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions suivantes:

1. l’appareil ne doit pas produire de brouillage;
l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

Radiation Exposure Statement:

The product complies with the Canada portable RF exposure limit set forth for an uncontrolled environment and are safe for intended operation as described in this manual. The further RF exposure reduction can be achieved if the product can be kept as far as possible from the user body or set the device to lower output power if such function is available.

Déclaration d'exposition aux radiations:

Le produit est conforme aux limites d'exposition pour les appareils portables RF pour les Etats-Unis et le Canada établies pour un environnement non contrôlé. Le produit est sûr pour un fonctionnement tel que décrit dans ce manuel. La réduction aux expositions RF peut être augmentée si l'appareil peut être conservé aussi loin que possible du corps de l'utilisateur ou que le dispositif est réglé sur la puissance de sortie la plus faible si une telle fonction est disponible.

This device is intended only for OEM integrators under the following conditions:

1. The transmitter module may not be co-located with any other transmitter or antenna.

If the condition above is met, further transmitter testing is not required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes:

1. Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.

Tant que les 1 condition ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

IMPORTANT NOTE:

In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the Canada authorization is no longer considered valid and the IC ID can not be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate Canada authorization.

NOTE IMPORTANTE:

Dans le cas où ces conditions ne peuvent être satisfaites (par exemple pour certaines configurations d'ordinateur portable ou de certaines co-localisation avec un autre émetteur), l'autorisation du Canada n'est plus considéré comme valide et l'ID IC ne peut pas être utilisé sur le produit final. Dans ces circonstances, l'intégrateur OEM sera chargé de réévaluer le produit final (y compris l'émetteur) et l'obtention d'une autorisation distincte au Canada.

End Product Labeling

The final end product must be labeled in a visible area with the following: "Contains IC: 3147A-BT852.

Plaque signalétique du produit final

Le produit final doit être étiqueté dans un endroit visible avec l'inscription suivante: "Contient des IC: 3147A-BT852".

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Manuel d'information à l'utilisateur final

L'intégrateur OEM doit être conscient de ne pas fournir des informations à l'utilisateur final quant à la façon d'installer ou de supprimer ce module RF dans le manuel de l'utilisateur du produit final qui intègre ce module. Le manuel de l'utilisateur final doit inclure toutes les informations réglementaires requises et avertissements comme indiqué dans ce manuel.

This radio transmitter (IC: 3147A-BT852 has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 3147A-BT852 a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés cidessous et ayant un gain admissible maximal. Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

EUROPEAN UNION REGULATORY

The BT85x has been tested for compliance with relevant standards for the EU market. BT852 was tested with a 0.5 dBi chip antenna.

The OEM should consult with a qualified test house before entering their device into an EU member country to make sure all regulatory requirements have been met for their complete device.

Reference the Declaration of Conformities listed below for a full list of the standards that the modules were tested to. Test reports are available upon request.

12.1. EU Declarations of Conformity

Manufacturer:	Laird	
Products:	BT852	
Product Description	BT852	BTv4.2 Dual Mode USB Dongle
EU Directives:	2014/53/EU – Radio Equipment Directive (RED)	



Reference standards used for presumption of conformity:

Article Number	Requirement	Reference standard(s)
3.1a	Low voltage equipment safety	IEC 62368-1:2014; and/or EN 62368-1:2014+A11:2017
		EN 62311:2008
	RF Exposure	EN 62479:2010
3.1b	Protection requirements with respect to electromagnetic compatibility	EN 301 489-1 v2.2.0 (2017-03) EN 301 489-17 v3.2.0 (2017-03)
3.2	Means of the efficient use of the radio frequency spectrum	EN 300 328 v2.1.1 (2016-11)

Declaration:

We, Laird, declare under our sole responsibility that the essential radio test suites have been carried out and that the above product to which this declaration relates is in conformity with all the applicable essential requirements of Article 3 of the EU Directive 1999/5/EC, when used for its intended purpose.

Place of Issue:	Laird W66N220 Commerce Court, Cedarburg, WI 53012 USA tel : +1-262-375-4400 fax: +1-262-364-2649
Date of Issue:	TBD
Name of Authorized Person:	Thomas T Smith, Director of EMC Compliance

Signature of Authorized Person:

Thomas T. Smith

BLUETOOTH SIG APPROVALS

13.1. Application Note: Subsystem Combinations

This application note covers the procedure for generating a new Declaration ID for a Subsystem combination on the Bluetooth SIG website. In the instance of subsystems, a member can combine two or more subsystems to create a complete Bluetooth End Product solution.

Subsystem listings referenced as an example:

Design Name	Owner	Declaration ID	Link to listing on the SIG website
BT852	Laird	D037603	https://www.bluetooth.org/tpg/QLI_viewQDL.cfm?qid=37603
Windows 8 (Host Subsystem)	Microsoft Corporation	B012854	https://www.bluetooth.org/tpg/QLI_viewQDL.cfm?qid=12854

Laird Customer Declaration ID Procedure

This procedure assumes that the member is simply combining two subsystems to create a new design, without any modification to the existing, qualified subsystems. This is achieved by using the Listing interface on the Bluetooth SIG website. [Antenna Matching – S11 Results](#)

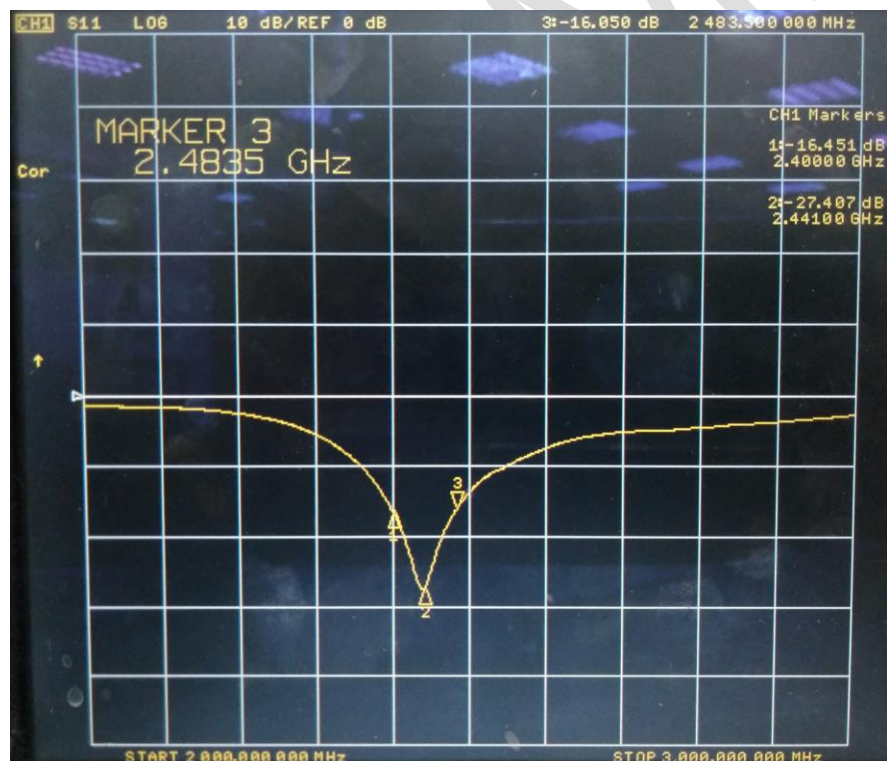


Figure 2: Antenna S11 on board

shows the basic subsystem combination of a controller and host subsystem. The Controller provides the RF/BB/LM and HCI layers, with the Host providing L2CAP, SDP, GAP, RFCOMM/SPP and any other specific protocols and profiles existing in the Host subsystem listing. The design may also include a Profile Subsystem.

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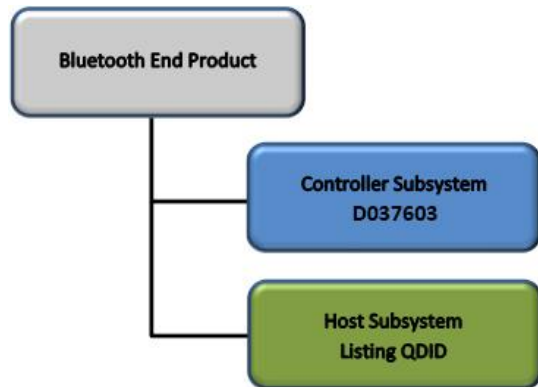


Figure 2: Basic subsystem combination of a controller and host subsystem

The Qualification Process requires each company to registered as a member of the Bluetooth SIG – <http://www.bluetooth.org>

The following link provides a link to the Bluetooth Registration page: <https://www.bluetooth.org/login/register/>

For each Bluetooth Design it is necessary to purchase a Declaration ID. This can be done before starting the new qualification, either through invoicing or credit card payment. The fees for the Declaration ID will depend on your membership status, please refer to the following webpage:

<https://www.bluetooth.org/en-us/test-qualification/qualification-overview/fees>

For a detailed procedure of how to obtain a new Declaration ID for your design, please refer to the following SIG document:

https://www.bluetooth.org/DocMan/handlers/DownloadDoc.ashx?doc_id=283698&vld=317486

To start the listing, go to: https://www.bluetooth.org/tpg/QLI_SDoc.cfm.

In step 1, select the option, **Reference a Qualified Design** and enter the Declaration IDs of each subsystem used in the End Product design. You can then select your pre-paid Declaration ID from the drop down menu or go to the Purchase Declaration ID page, (please note that unless the Declaration ID is pre-paid or purchased with a credit card, it will not be possible to proceed until the SIG invoice is paid.

Once all the relevant sections of step 1 are finished, complete steps 2, 3, and 4 as described in the help document. Your new Design will be listed on the SIG website and you can print your Certificate and DoC.

For further information please refer to the following training material:

<https://www.bluetooth.org/en-us/test-qualification/qualification-overview/listing-process-updates>

ADDITIONAL ASSISTANCE

Please contact your local sales representative or our support team for further assistance:

Laird Technologies Connectivity Products Business Unit

Support Centre: <http://ews-support.lairdtech.com>

Email: wireless.support@lairdtech.com

Phone: Americas: +1-800-492-2320

Europe: +44-1628-858-940

Hong Kong: +852 2923 0610

Web: <http://www.lairdtech.com/bluetooth>

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